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1977 Transactions

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INTERSTATE ANTELOPE CONFERENCE

1977 TRANSACTIONS

Papers presented at the annual meeting held in Alturas, California on March 14, 1978 are included in these transactions.

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CALIFORNIA DEPARTMENT OF FISH AND GAME

These transactions are available from the Chairman. Conference members, antelope project workers, and educational institutions may obtain copies subject to a very limited supply.

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CALIFORNIA

SHELDON-HART MOUNTAIN REFUGES

NEVADA

OREGON

Chairman:

L. "Bud" Pyshora

California Department of Fish and Game

Cover Design:

Bud Pyshora

CONFERENCE GUIDELINES

1. The annual meeting will be held on the second Tuesday in March, at Alturas, California. The 1978 meeting will be held on March 13, 1979.
2. The chairmanship of the conference will rotate between the four agencies represented. The Nevada Department of Fish and Game will provide the 1978 chairman, with Oregon, U.S. Fish and Wildlife Service and California following in that order. The 1978 chairman will be responsible for conducting the March 1979 meeting.
3. Each contributing agency shall provide 100 unstapled copies of their formal presentation. These shall be on standard 8 1/2 x 11 paper with pages unnumbered, printed single space on one side only, and with a margin of 1 1/2 inches for binding. The first page of the report shall carry the title, author's name, author's title, and organization.
4. The Chairman is responsible for compilation of the Conference Transactions covering that period for which he serves.
5. Transactions will be distributed in accordance with standing requests of participating agencies. Additional requests from other agencies, departments, and bureaus shall be honored at the discretion of the Chairman subject to availability. Added requests received by Conference members should be forwarded to the Chairman with a "Send" or "No Send" recommendation. Distribution of the 1977 Transactions was as follows:

<u>AGENCY</u>	<u>NO. COPIES</u>
California Department of Fish and Game 1416 Ninth Street Sacramento, California 95814	15
Nevada Department of Fish and Game P. O. Box 10678 Reno, Nevada 89510	15
Oregon Department of Fish and Wildlife P. O. Box 3503 Portland, Oregon 97208	15
Bureau of Land Management Federal Office Building 2800 Cottage Way, Room E-2820 Sacramento, California 95825	4

<u>AGENCY</u>	<u>NO. COPIES</u>
Bureau of Land Management 300 Booth Street Reno, Nevada 89502	6
Bureau of Land Management P. O. Box 2965 Portland, Oregon 97208	5
Modoc National Forest Alturas, California 96101	6
Fremont National Forest P. O. Box 551 Lakeview, Oregon 97630	2
U. S. Fish and Wildlife Service P. O. Box 111 Lakeview, Oregon 97630	10
National Park Service Klamath Falls Group P. O. Box 128 Klamath Falls, Oregon 97601	2

6. The current Chairman shall notify the following as to the time and place of the Conference. These individuals will have the responsibility for notifying those interested parties in his particular jurisdiction as to the time and place of the meeting.

<u>NAME</u>	<u>AGENCY</u>	<u>ADDRESS</u>
Director	Nevada Department of Fish and Game	P. O. Box 10678 Reno, Nevada 89510
Paul Ebert	Oregon Department of Fish and Wildlife	P. O. Box 3503 Portland, Oregon 97208
Dave Luman	Bureau of Land Management	P. O. Box 2965 Portland, Oregon 97208
Vic Masson	Oregon Department of Fish and Wildlife	P. O. Box 8 Hines, Oregon 97738
Stan Thompson	California Department of Fish and Game	P. O. Box 1480 Redding, California 96001
Refuge Manager	Sheldon-Hart Mountain Refuges	P. O. Box 111 Lakeview, Oregon 97630
Refuge Manager	Klamath Basin National Wildlife Refuges	Route 1, Box 74 Tulelake, California 96134

Superintendent	Lave Beds National Monument	P. O. Box 867 Tulelake, California 96134
Forest Supervisor	Fremont National Forest	P. O. Box 551 Lakeview, Oregon 97630
W. M. Shaw	Idaho Department of Fish and Game	P. O. Box 25 Boise, Idaho 83707
Bill Radtky	Bureau of Land Management	Federal Office Building 2800 Cottage Way Room E-2820 Sacramento, Calif. 95825
Forest Supervisor	Modoc National Forest	Alturas, California 96101
Jim Yoakum	Bureau of Land Management	300 Booth Street Reno, Nevada 89502
Superintendent	National Park Service Klamath Falls Group	P. O. Box 128 Klamath Falls, OR 97601

ATTENDANCE ROSTER

1977

<u>Name</u>	<u>Agency</u>	<u>Address</u>
Blaisdell, Jim	National Park Service	Klamath Falls, OR
Bloom, Clark	U.S. Fish & Wildlife Service	Alturas, CA
Deavers, Walt	Bureau of Land Management	Lakeview, OR
Donati, Bill	National Park Service	Lave Beds National Monument
Egeline, Steve	U.S. Forest Service	Lakeview, OR
Gerity, Art	Bureau of Land Management	Lakeview, OR
Hainline, Jim	U.S. Fish & Wildlife Service	Tulelake, CA
Hawks, Steve	Bureau of Land Management	Susanville, CA
Kaschke, Marvin	U.S. Fish & Wildlife Service	Lakeview, OR
O'Neill, Ed	U.S. Fish & Wildlife Service	Tulelake, CA
Page, Jerry	U.S. Bureau of Land Management	Cedarville, CA
Pinto, Carlos	U.S. Forest Service	Alturas, CA
Pyshora, L. "Bud"	Calif. Department of Fish and Game	Redding, CA
Salwasser, Hal	University of Calif. Berkeley	Alturas, CA
Silovsky, Gene	U.S. Forest Service	Lakeview, OR
Sinclair, David	U.S. Forest Service	Tulelake, CA

Sleznick, Jim	National Park Service	Lave Beds National Monument
Thayer, Doug	California Department of Fish and Game	Alturas, CA
Torland, Jim	Oregon Fish and Wildlife Department	Hines, OR
Worden, Larry	U. S. Fish and Wildlife Service	Lakeview, OR
Yoakum, Jim	Bureau of Land Management	Reno, NV

Eight thousand eight-hundred seventy-two (8,872) animals were counted in the 1977 California population. No animals were found on intervalle ranges in Surprise Valley. California's population was up 50% animals over 1977. This was the highest count since the previous census following was adopted in 1955. The 1978 count was the second highest count on record. In 1976 the count was 5,151 animals. California's envelope population had increased by 1,000 animals or 20 percent since the last population year of 1975. The 1978 count is 1,154 animals or 22 percent higher than the previous five-year average.

B. Buck Deer Ratio

The annual aerial herd population survey in northeastern California was conducted July 26, 28, 29, 30 and 31, 1977. Survey techniques were basically the same as used in past years. The counting method was modified to conform to the method suggested in the report "Envelope Deer Survey Counting" prepared by Eugene F. Hittich, Northern Research Service, California Department of Fish and Game. Hittich suggested the elimination of specified counting methods which were "statistically" asked for by the survey. The elimination of the specified methods from the survey was done in the interest of accuracy.

During the 1977 survey two thousand eight-hundred seventy-two envelope-type animals were classified. The Buck ratio was 75 Bucks per 100 does. This ratio is up 3 Bucks per 100 does over the 1975 count and equal to the previous five-year average.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF FISH AND GAME

1. Herd Surveys

a. Annual Census

The annual aerial census of antelope in northeastern California was conducted January 17, 19, 20 and 21, 1978. Winter ranges for the most part were snow free. Counting conditions were very poor due to cloud cover, fog and snow squalls. Antelope were well concentrated on winter ranges as a result of the previous six weeks of stormy weather.

Five thousand eight-hundred seventy-two (5,872) animals were counted in the basic California population. No antelope were found on interstate ranges in Surprise Valley. California's population was up 964 animals over 1977. This was the highest count since the present census technique was adopted in 1953. The 1978 count was the second highest count on record. In 1944 the count was 6,147 antelope. California's antelope population has increased by 4,092 animals or 230 percent since the low population year of 1960. The 1978 count is 1,274 animals or 22 percent higher than the previous five-year average.

b. Buck Doe Ratio

The annual aerial herd composition survey in northeastern California was conducted July 25, 26, 27, 28 and 29, 1977. Survey techniques were basically the same as used in past years. The sampling method was modified to conform to the method suggested in the report "Antelope Summer Survey Sampling" prepared by Eugene F. Wittick, Operations Research Branch, California Department of Fish and Game. Wittick suggested the elimination of specified counting locations which consistently showed low or zero counts. The elimination of the specific areas from the survey was done in the interest of economy.

During the 1977 survey two thousand eight-hundred seventy-three antelope were classified. The buck ratio was 29 bucks per 100 does. This ratio is up 3 bucks per 100 does over the 1976 ratio and equal to the previous five-year average.

c. Production

The 1977 kid ratio, obtained during the summer herd composition counts was 38 kids per 100 does.

The count was down 10 kids per 100 does from 1976 and 9 kids per 100 does below the previous five-year average of 47. The 1977 kid ratio was the lowest in the 25 years of herd composition surveys conducted in California.

d. Harvest

The fourteenth consecutive antelope hunt was held in northeastern California from August 27 through September 5, 1977. Adult bucks only were legal. Three hundred twenty-five (325) permits were issued on a statewide drawing basis. Permits cost \$15. The hunt area was divided into seven zones. One zone (Zone 7) was enlarged to include an area of antelope range extension. All hunters were required to report on the success of their hunt through the tag and report card system.

Hunters reported taking 271 antelope for an 83 percent success ratio. This was the highest hunter success on record. Hunter success has averaged 75 percent for the previous 13 hunts. Previous years hunter success has ranged from 59 to 82 percent. For the past five years hunter success has averaged 78 percent.

The percent of yearlings in the kill increased from 16 percent in 1976 to 21 percent in 1977. During the past 11 hunts the yearlings kill has ranged from 12 to 36 percent. The percent of four years and older age class in the 1977 kill was 38 percent, down from the record high of 48 percent of the kill in 1976. The percent of four years and older age class animals in the kill has ranged from 22 to 48 percent during the last 11 hunts.

The seventh annual hunter orientation session was held in Alturas the day before the hunt began. There were 100 people in attendance, of these 62 were permit holders. Many hunters consider this session to be a highlight of their hunt. The percent of permit holders that attend these sessions has ranged from 19 to 31 percent during the past seven years.

During the past fourteen years California has issued 4,325 antelope permits. Hunters have taken 3,233 for an overall success ratio of 75 percent. Antelope numbers have increased 124 percent since 1964 when the current series of hunts began.

The California Department of Fish and Game is requesting a special antelope hunt for 1978. The request calls for 400 permits. Regulations to be basically the same as in 1977. It has been requested that permit fees be increased from \$15 to \$35 to help defray cost of the management program.

II. Range Surveys

a. Weather Conditions

Seasonal precipitation and snowfall have been near normal. Late spring rains provided excellent growth of grasses and forbs in 1977. Summer water sources were very limited.

b. Range Modification

None specifically for antelope

c. Range Conditions

While spring and summer forage conditions were improved over the previous season, overall range conditions were considered fair.

III. Miscellaneous

a. Disease

No disease occurrence was reported in 1977. See letter appended to this report regarding blood sampling.

b. Tagging and Marking

On September 15, 1977 seventy-seven (77) antelope were trapped near Willow Ranch (Stearnes Ranch), Modoc County. Seventy of these were released near Skedaddle Ranch, Lassen County. Sixty-nine of these were ear tagged with orange, green or white streamers and numbered ear tags. Of the remaining antelope four were transported to the San Diego Zoo (two of these will eventually be sent to Japan); one was euthonized at the trap site; and two expired enroute to the release site.

IV. Summary

The 1978 census showed the basic California antelope population to be 5,872 animals. This count was up 964 animals over the 1977 total. California has had a 230 percent increase in its antelope population since 1960. The 1978 population is 22 percent higher than the previous five-year average.

The 1977 buck ratio was 29 bucks per 100 does. This was up three bucks per 100 over the 1976 ratio and equal to the previous five-year average.

The kid ratio for 1976 was 38 kids per 100 does, down 10 kids per 100 does from 1976.

The 1977 kid ratio is the lowest on record for California.

The fourteenth consecutive hunt was held in 1977. Three hundred twenty-five (325) permits were issued. Hunters reported killing 271 antelope for a success ratio of 83 percent. The success ratio is the highest on record for California.

Seventy-seven antelope were trapped in the Willow Ranch area of Modoc County. Seventy of these were translocated to the Skedaddle Ranch area of Lassen County. Sixty-nine of these animals were ear tagged and marked with colored streamers.

Range conditions for 1977 were considered fair.

TABLE I

Winter Aerial Census in Northeastern California

Year	Total Counted	*Erratic Winter Population	Basic California Population
1953	2247	122	2125
1954	2022	172	1850
1955	2137	180	1957
1956	2338	0	2338
1957	2080	107	1973
1958	2165	0	2165
1959	1917	0	1917
1960	1961	181	1780
1961	2068	162	1906
1962	2354	85	2269
1963	2498	123	2375
1964	2618	0	2618
1965	2468	0	2468
1966	2898	163	2735
1967	2665	128	2537
1968	2607	0	2607
1969	2971	101	2870
1970	2999	16	2983
1971	3800	0	3800
1972	3764	0	3764
1973	4357	0	4357
1974	4747	0	4747
1975	4109	0	4109
1976	4987	118	4869
1977	4908	0	4908
1978	5872	0	5872

*Erratic winter populations occupying interstate ranges east of the Warner Mountains subtracted from total, leaves the basic California population.

TABLE II

Antelope Herd Composition Summary

Year	Population	Ratio			No. Classified
		Bucks:	Does:	Kids	
1954	1850	58	100	84	689
1955	1957	52	100	77	1020
1956	2338	51	100	57	927
1957	1973	58	100	66	861
1958	2165	59	100	70	1390
1959	1917	46	100	53	1496
1960	1780	32	100	39	1079
1961	1906	44	100	64	1042
1962	2269	39	100	42	1493
1963	2375	44	100	62	1721
1964	2618	47	100	57	1918
1965	2468	44	100	52	1592
1966	2735	35	100	40	1718
1967	2537	40	100	58	1963
1968	2607	39	100	61	2025
1969	2870	37	100	69	2336
1970	2983	35	100	63	2779
1971	3800	41	100	40	3089
1972	3764	33	100	55	3289
1973	4357	34	100	42	2769
1974	4747	26	100	41	2711
1975	4109	28	100	51	2844
1976	4869	26	100	48	2886
1977	4908	29	100	38	2873

TABLE III

Buck Antelope Kill by Season

Year	Permits Issued	Reported Kill	Hunter
			Success Ratio
1942	500	405	.81
1943	500	362	.72
1944	500	322	.64
1945	500	307	.61
1949	500	349	.70
1951	416	280	.67
1959	171	120	.70
1964	240	183	.76
1965	240	141	.59
1966	265	179	.68
1967	250	159	.64
1968	260	189	.73
1969	270	204	.76
1970	300	241	.80
1971	400	303	.76
1972	380	301	.79
1973	385	305	.79
1974	410	284	.69
1975	225	170	.76
1976	375	306	.82
1977	325	271	.83

1977 ANTELOPE STATUS REPORT

SHELDON-HART MOUNTAIN NATIONAL ANTELOPE REFUGES & CHARLES SHELDON ANTELOPE RANGE

Larry Worden, Biologist
U. S. Fish and Wildlife Service

I. HERD SURVEYS

A. Annual Census Activities

1. A mid-winter census was not made in 1977. Flights were made on January 25, 1978. Due to snow cover and other weather conditions, classification was not attempted. A total of 1670 antelope were counted on Hart Mountain and Sheldon. This is nearly identical to the 1696 found during the summer survey. Big Springs Table had 1280, or 77% of the total with 900 being in one band on the east end of the Table. Hart Mountain held 390, all in the Flook Lake area.

2. The summer production survey, usually taken in July, was delayed until August 16 and 17. All areas were flown. Table I presents survey results since 1971.

TABLE I. Summer Population Trends

Unit	1971	1972	1973	1974	1975	1976	1977
Hart Mtn. Biological Unit*	310	454	646	496	369	1046	636
Sheldon Biological Unit*	874	728	792	867	549	799	1060
Total Sheldon-Hart Mtn.	1184	1182	1438	1363	918	1845	1696

* Biological Unit areas described in 1975 Conference Report.

B. Buck-Doe Ratios

A ratio of 28 buck/100 does has not changed significantly in recent years, but is 8 bucks below the 10 year average. By area the ratio ranged from 10 bucks/100 does in Sagehen Hills (Oregon) to 63 bucks/100 does on the Sheldon Refuge.

C. Production

Production for the combined biological units was down to 16

kids/100 adults, compared to 44 last year. Some of the possible causes are a second year of drought with low forage production and poor water conditions, coupled with high coyote numbers.

TABLE II. Summer Herd Ratios Sheldon-Hart Mountain Biological Units

	1971	1972	1973	1974	1975	1976	1977
Number Classified	1184	1182	1423	1363	918	1832	1696
Bucks	299	261	265	328	164	296	321
Does	794	667	925	906	570	977	1142
Kids	91	254	233	129	174	559	233
Bucks/100 Does	38	39	29	36	29	30	28
Kids/100 Does	11	38	25	14	31	57	20
Kids/100 Adults	8	27	20	10	24	44	16

Hart Mountain again had better production than Sheldon although not as spectacular as in 1975 and 1976. This trend began in 1971 following the establishment of a deferred grazing system on Hart Mountain in 1970. Coyote control has not been practiced on either area since 1967.

TABLE III. A Comparison of Antelope Production Ratios on Hart Mountain Refuge and Sheldon Range

Kids per 100 Adults	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Hart Mountain	17	16	31	10	35	19	18	35	59	20
Sheldon Range	17	17	34	6	21	14	8	11	22	14

The improvement in overall range condition on Hart since 1971 and its probable influence on antelope production was described in the 1976 report.

D. Harvest

Trophy class antelope hunting programs continued for the 11th year on Sheldon Range and the 10th year on Hart Mountain Refuge. On Sheldon 25 permits were split with 13 hunters allowed from 8/27 to 9/5 and 12 hunters from 9/3 to 9/11. Hart's 15 permit holders could hunt 8/27 to 8/31. Tables IV and V summarize results since the hunts began in 1967.

TABLE IV. Summary of Sheldon Antelope Hunts

Year	No. Hunters	Successful	%Success	Boone & Crockett Scores		
				High	Low	Average
1967	10	10	100	75-5/8	45-1/8	69-2/8
1968	10	10	100	81-2/8	64-2/8	73-6/8
1969	20	20	100	78-4/8	64-3/8	70-3/8
1970	20	17	85	86-2/8	57-4/8	72-5/8
1971	19	18	95	81-4/8	46-6/8	73-5/8
1972	20	17	85	80-4/8	63-1/8	71-4/8
1973	20	20	100	84-	59-2/8	72-6/8
1974	20	19	95	85-2/8	63-4/8	70-6/8
1975	20	19	95	87-4/8	64-	74-6/8
1976	24	24	100	86-	54-6/8	73-7/8
1977	25	24	96	90-6/8	63-3/8	76-7/8

TABLE V. Summary of Hart Mountain Antelope Hunts

Year	No. Hunters	Successful	% Success	Boone & Crockett Scores		
				High	Low	Average
1968	10	9	90	82	65-6/8	74-5/8
1969	16	15	94	77-6/8	64-2/8	70-3/8
1970	15	15	100	81-6/8	65-2/8	73
1971	14	11	79	75	65-4/8	69-4/8
1972	15	15	100	78-4/8	53	69-7/8
1973	16	13	81	79	57-4/8	68-4/8
1974	15	14	93	81-5/8	53-4/8	69-2/8
1975	15	11	73	77-4/8	46-6/8	68-5/8
1976	16	16	100	88-4/8	62-2/8	72-6/8
1977	15	15	100	81-2/8	66-2/8	74-1/8

Two bucks from Sheldon exceeded the Boone and Crockett minimum score of 82. One measured an even 82 unofficial green score.

The other, taken on Rock Springs Table scored 90-6/8, which matches the eighth ranked head in the 1977 edition of North American Big Game. Number 9 in the book is a score of 90 taken on Guano Creek, Oregon, in 1942. Number 16 is an 88-4/8 taken on Hart Mountain last year. The previous record for Nevada is a 87-2/8 taken on Gooch Table in 1975. The one unsuccessful hunter passed up many excellent antelope in his search for a high scoring trophy. Since hunting began 208 hunters have taken 198 antelope from Sheldon. On Hart Mountain, 147 hunters have taken 134 antelope.

Age of Harvested Antelope

This year, one incisor was collected from each jaw. These were sent to Matson Commercial Microbiological Laboratory, Missoula Montana, for aging. For Sheldon the average age is 6.7 years, with 75% exceeding 6.5 years. Hart Mountain had a considerably lower average of 4.1 with 73% being less than 5.5 years old. The oldest animal was 10.5 years from Hart Mountain. Most high scoring heads were 4.5 years or older. The 90.6 score was 5.5 years old, while the 82 score was 8.5 years. Cost for the lab work, which included a slide of each tooth was \$2.00 per tooth.

II. RANGE SURVEYS

A. Weather Conditions

The two year drought ended in December, when nearly 2 inches of precipitation was recorded at Dufurrena. Other months of this year, with the exception of May and June had below normal moisture.

B. Range Modification

On Sheldon four springs were renovated by installing collection facilities and piping the water to tanks located off the meadows. Overflows were diverted back to the meadows. Annual maintenance of drift fences on Gooch and Rock Spring Tables was accomplished.

In 1977, Bill Anderson, retired SCS State Range Conservationist from Oregon, was hired and during the summer completed mapping the entire Sheldon Refuge and Range using the Ecological Site Handbook he developed for the High Desert Resource Province. This information was transferred to an aerial mosaic of 1" to the mile which will be the base map for a Coordinated Resource Management Plan currently being developed. Mr. Anderson will continue his field work during the summer of 1978 to develop trend and condition information.

Wild horses numbering about 800 shared antelope ranges on Sheldon throughout the year. A Horse Management Plan and E.I.S.

were written and approved. A contract for removal of 400 head was awarded. Hopefully, up to 700 head will be taken off Sheldon in 1978. Plans have not yet been made for removal of \pm 150 horses on Hart Mountain.

C. Range Evaluation

Water distribution and quality was generally poor during the summer months. Although cattle numbers were reduced or non use taken on several areas due to drought, the high horse population more than offset the savings of forage and water. Forbs production on the playas and lake beds was low and of short duration.

III. MISCELLANEOUS EVALUATIONS

A. Disease

None observed.

B. Predation

Nothing of significance observed. Coyote scent post lines indicate a high coyote density. This type survey will be modified and intensified on both refuges next year.

C. Food Habitat

Nothing to Report

D. Research

I. Horse - Antelope Competition

A two year study of horse-antelope competition and conflicts was begun by J. O. Meeker, a master's degree candidate working under Dr. R. Beall, University of Nevada, Reno. The following taken from Meeker's study proposal describes the project.

The purpose of the proposed research is an in-depth study of the interaction between pronghorn antelope and feral horses during the summer months in a sagebrush-bunchgrass community in northwestern Nevada. The specific study area selected is the Round Mountain-North Rock Springs Table area located in the northwest portion of the Sheldon Antelope Range. Geological survey maps indicate that a limited water supply exists in the area.

The results of this study will be discussed in terms of competition either interference or exploitation, which may exist between the two species in terms of food, water and space. These results will be applicable to all such pronghorn-feral horse management considerations in sagebrush-bunchgrass communities. Because a portion of the research will be concerned with water-hole interactions, the results will be applicable to other pronghorn-feral horse situations where limited water exists regardless of the vegetative community.

OBJECTIVES

1. Determine the summer food habits of pronghorn antelope and feral horses within the study area.
2. Determine the percentage of vegetative cover and forage production of a pronghorn antelope/feral horse summer range.
3. Describe interaction between pronghorn antelope and feral horses on feeding areas and at springs during the summer on pronghorn antelope/feral horse range.
4. Assess the degree of competition between pronghorn antelope and feral horses for resources during the summer on the Charles Sheldon Antelope Range.

II. Antelope Production and Movement Study.

This study is being conducted through the Cooperative Wildlife Research Unit, University of Montana. Bart O'Gara, Unit Leader is principle investigator. Mark McNay, a master's degree candidate will do the first year's field work which will begin in May 1978 with the placing of transmitters on fawns. The following is taken from the study proposal:

"Purpose: To examine the causes and degree of pronghorn fawn mortality. To evaluate the condition of newborn fawns as an indicator of their dams' nutritional status, and thus, indirectly, the adequacy of the range for pronghorns. To evaluate if fawn bedding sites are adequate or not; and, if not, whether livestock use is responsible. To mark, with radio and rope collars, a large number of pronghorns on the Range during winter and follow their dispersal to seasonal ranges. To evaluate, by blood parameters, the nutritional status of trapped pronghorns. Depending on findings during the first 2 years of study and with concurrence of the Range Manager, employ and monitor some type of experimental predator control to determine whether or not such control would ultimately increase the pronghorn population."

IV. SUMMARY

A. No mid-winter survey was made in 1977. A 1978 flight, made on January 25, found 77% of the Sheldon-Hart herds on Big Springs Table winter range.

B. Although there was a slight increase of adults from 1976, the small numbers of kids brought the total population down slightly.

C. The buck - doe ratio of 28/100 has not changed much in recent years but is 8 bucks below the 10 year average.

D. Production for the combined biological units is down to 16 kids/100 adults from 44/100 in 1976. Two years of drought plus high horse numbers and predation are possible reasons for low production. Production on Hart Mountain has been better than on Sheldon since 1971, when deferred grazing was begun on Hart Mountain.

E. A new record for Nevada measured 90-7/8. This antelope taken from Rock Springs Table may rank No. 8 or No. 9 in Boone and Crockett records.

F. A two year study of competition between horses and antelope was begun. A range site survey was completed and a Coordinated Resource Management Plan is being developed.

V. RECOMMENDATIONS

A. Hunting - No significant changes.

B. Range Modifications - Implement Coordinated Resource Management Plan on Sheldon. Remove excess horses in accordance with the Horse Management Plan.

C. Predator Control - No change this year.

D. Research - Continue antelope fecundity and survival and movements study.

NORTHWESTERN NEVADA ANTELOPE STUDIES
BILL FOREE
GAME AGENT II
NEVADA DEPARTMENT OF FISH AND GAME

I. HERD SURVEYS

A. Annual Census

Aerial surveys conducted in March, 1977 resulted in a count of 2,619 antelope. This was an increase of 548 animals or 26.4% more than that counted in 1976. This increase amounted to 35.2% in northern Washoe County and 4.0% in Humboldt County. The increase in northern Washoe County may have been due in part to immigration from California and the Sheldon. Table I represents a five year population trend.

B. Buck-Doe Ratio

During 1977 winter flights, a buck-doe ratio of 37/100 was obtained compared to a ratio of 29/100 in 1976. On those flights in north Washoe, yearling bucks were classified in an attempt to gage the eventual recruitment by the 1976 kid crop. This classification is difficult and results cannot be considered hard data at present. There were an estimated 47 yearlings per 100 does remaining from a summer ratio of 66 kids per 100 does indicating a loss of 29%.

Summer composition counts in 1977 showed a ratio of 39 bucks per 100 does compared to 40 bucks per 100 does in 1976.

C. Production

A total of 2,149 antelope were classified in August, 1977. There were 471 bucks, 1,209 does and 469 kids observed for a ratio of 39 B/100 D/39 K. In 1976, there were 64 kids per 100 does. Production ranged from 20 kids per 100 does in the New Year Lake unit to 61 kids per 100 does in the Smoke Creek Unit. Ratios in other units ranged between 35 to 40 kids per 100 does. Table II summarizes 1977 production data by unit.

In addition to the above units, there were 883 antelope observed on the Sheldon of which 713 were classified for a ratio of 33 B/100 D/7.5 K.

D. Harvest

The regular season in 1977 ran from August 27 through September 5, except the late season on the Sheldon ran from September 3 through September 11. There were 315 tags available in areas covered by this report. A total of 277 antelope were reported harvested for an overall success of 88%, the same as 1976 which was a record high. Table III summarizes hunt results for 1977.

An antelope archery hunt was held August 13-21 with 50 tags available in all open areas of the state except the Sheldon. A total of 8 animals were

taken by bow hunters for a success rate of 18%.

Substantial data has been collected at the Gerlach checking station since 1973 on age class of harvest and Boone and Crockett scores. A total of 282 antelope were checked over a five year period. Age classes were based on incisor replacement. Data shows that the harvest over the past five years has been on the average 14.3% yearlings, 20.1% 2-years old, 17.7% 3-years old and 47.9% 4-years or older. It would appear that the younger age classes in the harvest has increased while older classes decreased slightly. Table IV represents age class distribution.

Table V summarizes average trophy quality by year. The majority of Boone and Crockett scores are green and unofficial. Horn height represents the longest horn only in inches.

II. RANGE SURVEYS

A. Weather-Precipitation

Two full growing seasons of drought conditions have just ended. The Reno weather station reported receiving 5.06" and 5.81" of precipitation in 1976 and 1977 respectively. A long-term average is 7.2 inches. For 1977 43% of the annual total came in December. As of January 26, 1978, a total of 4.66" of precipitation had been recorded at the Reno station.

The Winnemucca station received 7.31" of precipitation in 1976 and 8.08" in 1977. The average is 8.63 inches. Generally, the past two years winter precipitation (October through March) has been much below normal while summer precipitation (April through September) has been much above normal.

During the 1977 antelope kidding season, precipitation was frequent, over 50% above normal in May and up to 200% or more above normal in June.

This winter (1977-78) has brought average or above average precipitation. Soil moisture is excellent and the snowpack looks good.

B. Range Modifications

None were reported in 1977.

C. Range Evaluation

Range conditions were remarkably good considering drought conditions. Free water was extremely limited and did influence antelope distribution greatly. Input into land management agencies planning unit reports is almost completed. This includes, among other things, antelope numbers and forage requirements (AUMs) by season of use.

III. MISCELLANEOUS EVALUATION

A. Disease

None reported.

B. Predation

There is not much effort spent on this, however, one antelope kid mortality was discovered during a post season helicopter survey in the Smoke Creek unit. The kid had been killed and partially eaten by a bobcat which was driven from the carcass during landing.

C. Food Habits

No data.

IV. SUMMARY OF DATA

A. The antelope population remains at a high level and showed an increase in numbers of 26.4% the past year. Some of this increase, particularly in northern Washoe County is attributed to immigration of antelope from the Sheldon and California.

B. Buck-doe ratios remain high and are well above that needed for breeding purposes allowing for an annual harvest of surplus bucks.

C. Production averaged 39 kids per 100 does in 1977, a decrease of 39% from 1976.

D. Hunter success averaged 88% in 1977, the same as 1976 and represents the two best years on record.

E. Land management agencies have requested the Fish and Game Department to provide them with reasonable antelope numbers using the public range with the intent of reserving forage (AUMs) for these animals. This has been completed, except for the Sheldon where work is currently in progress.

V. RECOMMENDATIONS.

A. Continue annual aerial herd composition surveys to measure antelope population trend and production.

B. Continue trophy hunts based on surplus bucks available by unit.

C. Continue to monitor the impact of various grazing systems on antelope populations.

D. Continue to provide land management agencies with antelope habitat needs and recommendations for achieving these.

TABLE I
Population Trend

<u>Unit</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
New Year Lake	0	126	60	216	422
Hart Camp	924	934	693	581	898
Smoke Creek	338	404	502	692	694
Summit Lake	234	266	200	181	237
Kings River	154	147	121	104	36
Santa Rosa	229	367	362	297	332
Total	1,879	2,244	1,938	2,071	2,619

TABLE II
Herd Composition 1977

<u>Unit</u>	<u>No. Classified</u>	<u>Bucks</u>	<u>Does</u>	<u>Kids</u>	<u>B/100 D</u>	<u>K/100 D</u>
New Year Lake	377	81	247	49	33	20
Hart Camp	791	154	452	185	34	41
Smoke Creek	458	128	205	125	62	61
Summit Lake	173	37	99	37	37	37
Kings River	128	25	76	27	33	36
Santa Rosa	222	46	130	46	35	35
Total	2,149	471	1,209	469	39	39

TABLE III
Harvest 1977

<u>Unit</u>	<u>No. Tags</u>	<u>Returns</u>	<u>Harvest</u>	<u>Un- Succ.</u>	<u>Did Not Hunt</u>	<u>% Success</u>
New Year Lake	40	40	37	3	0	92
Hart Camp	95	93	83	10	0	89
Smoke Creek	100	100	87	11	2	87
Summit Lake	20	20	15	5	0	75
Kings River	5	5	4	1	0	80
Santa Rosa	30	30	27	3	0	90
Sheldon	25	25	24	1	0	96
Total	315	313	277	34	2	88%

TABLE IV
Antelope Age Class Distribution
By Harvest Year

Year	Yearling		2 Years		3 Years		4 Years		Total No.
	No.	%	No.	%	No.	%	No.	%	
1973	4	9.8	9	22.0	11	26.8	17	41.5	41
1974	7	10.9	14	21.9	8	12.5	35	54.7	64
1975	1	2.9	3	8.8	6	17.6	24	70.6	34
1976	6	18.2	6	18.2	6	18.2	15	45.5	33
1977	19	21.8	20	23.0	15	17.2	33	37.9	87
Total	37	14.3	52	20.1	46	17.7	124	47.9	259

TABLE V
Average Trophy Quality By Year

Year	Number	Avg. B/C	Range	Avg. Height	Range
1973	58	67.284	46.875-79.25	13.039	7.375-16.5
1974	67	68.593	46.0-83.5	13.211	7.375-17.125
1975	37	69.716	42.5-82.75	13.541	6.0-15.75
1976	33	67.057	44.75-81.75	12.917	7.75-16.75
1977	87	68.560	46.75-84.5	12.759	7.00-16.75
Total	282	68.282	42.5-84.5	13.045	6.0-17.125

OREGON ANTELOPE REPORT - 1977

Jim Torland - Wildlife Biologist
Oregon Department of Fish and Wildlife

Herd Survey

A. Annual Census

The 1977 aerial census was largely completed in March, but some of the sample was not completed until April. Counting conditions were good but the antelope were scattered from winter ranges to summer ranges. Because of this some biologists thought their figures were low.

A total of 8,757 antelope were counted on 4,015 miles of route. An average of 2.2 antelope per mile was 22 percent above the 1976 and 16 percent above the ten year average. The majority of the change was noted in the Harney District. Counts were 36 percent above the 1976 figures and the highest ever recorded for the district. The Harney counts represent 63 percent of all antelope inventories. (Table 1)

In several areas antelope appear to be increasing their range. Some are even moving into areas not classified as antelope habitat such as pine and mixed conifers. New populations have been noted in the Interstate, Maury and Murderers Creek Management Units.

B. Buck-Doe Ratios

Prior to the late August hunting season, 3,292 antelope were classified. Bucks per 100 does increased from 25 in 1976 to 26 in 1977. The count is still below the ten year average but high enough for adequate breeding and hunting. (Table 2)

C. Production

Fawn production was down from 1976 counts 25 percent (40 to 30 per 100 does). The 1977 production was also 17 percent below the ten year average. Poor range conditions, drought and predation are all thought to be contributing factors in this low fawn survival. Biologists in the Paulina, Maury and Silvies Management Units (Central Oregon) think their antelope are barely holding their own and list food, water distribution and coyote predation on young as major reasons for this.

In one area of intensive coyote control using trapping, plane and helicopter gunning, kid survival was increased from 30 kids per 100 does to 113 kids per 100 does. It appears from this and other

instances that if antelope are below their carrying capacity and low fawn production due to predators is a problem, dramatic results can be experienced through predator removal.

The predator control project on a selected portion of the Wagontire Unit was continued. A total of 53 adults and 60 pups were removed from about 300 square miles of kidding ranges in May. Nearly every adult coyote was found by circling a lone doe with the helicopter. Fall herd composition in the control area remains 69 percent below the state average (11 kids/100 doe).

D. Harvest

A total of 1400 antelope tags were available to rifle hunters during the August 27 through August 31 season for bucks with horns longer than the ears. Report card returns showed an excellent 74 percent success rate. Very similar to the 71 percent success experienced in 1976. Table 3 lists the hunter questionnaire figures and projected harvests. The Warner Unit was closed due to low population levels.

One hundred and twenty doe antelope rifle permits were issued in two areas where antelope were causing damage on private lands. A total of 77 does (86 percent success) were reported harvested.

Some problems were experienced with killing of legal bucks and fawn bucks. It is felt that this can be greatly reduced by a mandatory indoctrination course with mounted heads and pictures to show what a doe looks like.

The issuing of antelope doe permits as a management technique to control animal numbers and damage is questionable for the future. Closure of the Warner Unit to hunting prompted our Commission to recommend trapping and transplanting from damage areas to areas of low population rather than issue doe tags.

Bowhunting permits for the Gerber area were increased from 150 to 200. Only one buck was reported harvested.

Range Surveys

A. Weather Conditions - Precipitation

The winter of 1976-77 was one of the driest on record. Antelope were able to winter on ranges usually used only in the summer. The summer continued hot and dry and water supplies became critical on many ranges. Competition with wild horses was serious although no losses were actually documented. Low kid survival for 1977 may be a partial result of the drought.

B. Range Modifications

No projects were undertaken on antelope range.

C. Range Evaluation

Poor range conditions existed due to the drought.

Miscellaneous

A. Disease, Parasites

No evidence of mortality from disease or parasites was found.

B. Bear Valley Antelope Herd

About 500 antelope were counted in Bear Valley during the August census. Bucks per 100 does (71) and kids per 100 does (73) were the highest in the state. (Table 4) Removal of 72 does and 22 bucks did not even equal the 1977 production so the damage problem remains the same. These antelope will be trapped if they remain in the valley like they did in 1976-77.

C. Ordance Depot Herd

The Ordance Depot herd in Umatilla County has increased from the March, 1969 plant of 10 does, 2 buck and 5 kids to 100-125 animals. The population has probably reached its carrying capacity and is reflected in the fawn production of 33 per 100 does. No hunting is allowed and buck ratios are about 100 per 100 does. A limited number of coyotes are removed by the federal trapper each year.

Summary

- A. The population index increased in 1977. The 8,757 counted in 4,015 miles of aerial census was 22 percent above the 1976 average and 16 percent above the ten year average. The Harney District counts represent the greatest changes and the greatest percentage of all antelope inventoried (63 percent).
- B. Herd composition work revealed 26 bucks per 100 does which was one above the 1976 inventory. This ratio is still 7 percent below the 10 year average but good enough for breeding purposes and successful hunting. Kid production was down 25 percent from 1976 but only 17 percent lower than the 10 year average. Food, water distribution and predation are thought to be partially responsible for the decline.
- C. A total of 1520 rifle tags and 200 archery tags were offered in 1977. Of the 1520, 120 were doe permits. Based on a 79 percent report card return, buck hunters harvested 700 antelope and doe

hunters took 77. Rifle hunter success was similiar to last year but archery success was down to 1 percent from 10 percent.

- D. The 1976-77 drought produced poor range conditions and made water critical in many areas.

Recommendations

- A. Discuss the problem of low kid survival on our desert ranges with Department and University personnel. Attempt to develop interest in a study of this problem.
- B. Check possibility of surveying antelope hunters through the hunter report card to see if they are satisfied with their hunt.

Table 1

1977 AERIAL ANTELOPE INVENTORY

Unit	District	Miles	Antelope	Antelope per Mile		
				1977	1976	10-Year Average
Beulah	Malheur	200	250	1.3	3.4	2.8
Ft. Rock-Silver Lk.	Lake	225	297	1.3	0.9	0.7
Beatys Butte	Harney	900	2,090	2.3	2.2	2.4
Interstate	Lake	50	111	2.2	-	1.2
Juniper	Harney	240	1,331	5.6	1.2	1.8
	Lake	50	184	3.7	-	3.3
Malheur River	Harney	140	799	5.7	7.9	3.9
	Malheur	100	113			
Maury	Deschutes	200	214	1.1	0.9	0.8
	Ochoco	125	108	0.9	-	2.8
Murderer's Creek	Harney	40	520	13.0	0.4	-
Ochoco	Ochoco	125	532	4.3	-	1.7
Owyhee	Malheur	250	373	1.5	2.7	2.9
Paulina-Wagontire	Deschutes	450	513	1.1	1.4	1.8
	Harney	60	121	2.0	0.4	0.9
Silvies	Ochoco	75	161	2.2	-	1.6
	Harney	60	171	2.9	1.1	1.1
Steens Mt.	Harney	220	457	2.1	2.2	1.6
Warner	Lake	105	162	1.5	-	3.8
Whitehorse	Malheur	400	250	0.6	1.9	1.3
TOTALS and AVERAGES		4,015	8,757	2.2	1.8	1.9

Table 2

1977 ANTELOPE HERD COMPOSITION

Area	Wildlife Management District	Antelope Classified				Bucks Per 100 Does			Fawns Per 100 Does		
		Bucks	Does	Fawns	Total	1977	1976	Ave.	1977	1976	Ave.
Beaty's Butte	Harney Lake	76	277	77							
		29	84	9							
		105	361	86	552	29	15	26	24	41	34
Beulah Juniper Malheur	Malheur	17	48	14	79	35	38	29	29	51	39
	Harney	57	222	55	334	26	13	27	25	16	27
	Harney	20	92	34							
	Malheur	1	8	1							
		21	100	35	156	21	58	33	35	51	37
Maury Murderer's Cr. Ochoco Owyhee Paulina- WAgontire	Ochoco	4	49	15	68	8	22	31	31	24	26
	Harney	142	210	146	498	71	45	52	73	53	73
	Ochoco	72	202	84	358	36	32	33	42	79	49
	Malheur	4	30	4	38	13	15	19	13	37	26
	Deschutes	32	148	17							
	Harney	8	33	3							
	Lake	2	23	9							
		42	204	29	275	21	15	22	14	19	24
Silvies	Ochoco	3	64	15							
	Harney	1	31	11							
		4	95	26	125	4	13	22	27	29	29
Steens Mt. Warner Whitehorse	Harney	34	197	43	274	17	24	29	22	27	36
	Lake	10	143	31	184	7	-	22	22	-	30
	Malheur	31	224	65							
	Harney	5	22	4							
		36	246	69	351	15	21	22	28	46	36
TOTALS AND AVERAGES		548	2,107	637	3,292	26	25	28	30	40	36

Table 3

1977 BUCK ANTELOPE SEASON
(79% Report Card Return)

Hunt Number	Name of Area	Tags Issued	Report Cards Received	Number Did Not Hunt	Number Hunted	Reported Harvest	Percent Success	Hunter Days
435A	Part Paulina & Wagontire Units	50	43	1	42	28	67	101
436	Maury Unit	50	47	1	46	32	70	120
437	Ochoco Unit	70	58	2	56	52	93	112
438	Grizzly Unit	10	9	0	9	6	67	19
446	Murderer's Creek Unit	25	22	0	22	22	100	24
451A	N. Part Baker Unit	10	8	1	7	6	86	8
451B	S. Part Baker Unit	10	9	0	9	8	89	17
464	Lookout Mountain Unit	10	8	0	8	7	88	14
465	Beulah Unit	75	58	4	54	47	87	104
466	Malheur River Unit	150	109	5	104	85	82	212
467	Owyhee Unit	125	91	1	90	70	78	225
468	Whitehorse Unit	200	156	8	148	97	66	398
469	Steens Mountain Unit	160	130	5	125	85	68	305
470	Beatys Butte	160	129	0	129	110	85	265
470A	National Antelope Refuge	15	15	0	15	14	93	28
471	Juniper Unit	125	88	1	87	60	69	189
472	Silvies Unit	50	44	0	44	37	84	98
473A	S. Part Wagontire Unit	35	27	0	27	13	48	77
475A	E. Part Interstate Unit	50	39	2	37	19	51	105
476A	Fort Rock-Silver Lake Units	20	18	0	18	11	61	46
		1,400	1,108	31	1,077	809	75	2,467

1977 DOE ANTELOPE SEASON

437A	Portion Ochoco Unit	20	14	2	12	5	42	17
446A	Murderer's Creek Unit	50	39	1	38	34	89	58
446B	Murderer's Creek Unit	50	41	1	40	38	95	65
		120	94	4	90	77	86	140

1977 ANTELOPE BOW SEASON

475B	Gerber Reservoir Area	200	94	4	90	1	01	443
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Table 4

Bear Valley Herd Composition

Year	Antelope Classified				Total	per 100 does	
	Bucks	Does	Kids	Unclass.		Bucks	Kids
1972	35	74	76	14	199	47	103
1973	80	73	42	1	196	110	58
1974	22	89	51	-	162	25	57
1975	46	103	102	-	251	45	99
1976	91	149	138	-	378	61	93
1977	142	210	146	-	498	71	73

MANAGING RANGELANDS FOR THE AMERICAN PRONGHORN ANTELOPE

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Highlight: Pronghorns thrive best on rangelands with a diversity of vegetation, an abundance of grass-forb-browse, plants with high succulence, and growth height from 38 to 61 cm. Cultivated crops usually are not consumed extensively except alfalfa which is highly preferred. Antelope densities are best on range where water is available every 2 to 8 km. It is desirable to have 1 to 4 liters of free water available each day, particularly during the warm dry summers. These big game animals use man-made water developments such as reservoirs, troughs and water catchments. Fences which restrict antelope movement for habitat requirements can be detrimental, especially for migrating herds during winters of deep snows. Woven wire fences are generally a barrier and therefore, are not recommended on antelope ranges. Vegetational type manipulation projects can be advantageous or deleterious as defined. Ranges managed to meet the habitat requirements of antelope can be maintained or improved for the welfare of antelope today.

INTRODUCTION

Today the American pronghorn antelope (*Antilocapra americana*) inhabits many historic ranges occupied during the early 1800's. The antelope's pristine numbers, however, have been greatly reduced. These native big game animals were on the verge of extirpation at the turn of the 1900's, but have experienced a 1,500 percent increase during the past 50 years. Pronghorns coexist on western rangelands from northern Mexico, up through all the western states of the U.S., and into the southern short grasslands of south-central Canada. They coexist with domestic livestock now just as they did with the American buffalo (*Bison bison*) for centuries prior to the arrival of European man (Yoakum 1968).

The objective of this paper is to identify recommended range management practices to maintain or improve forage, water, and range conditions in accordance with the habitat requirements of the American pronghorn antelope.

Findings and recommendations in this report were gathered over 25 years of research and field studies conducted in Canada, Mexico, and the United States. In addition, the author has relied heavily on State and Federal agencies' input into the antelope chapter of a report entitled "Wildlife Habitat in Managed Range Environments" being drafted (Kindschy et al, in prep.).

ANTELOPE HABITAT REQUIREMENTS

To better understand the interrelationships of pronghorns to range-lands, it is imperative to know the animal's requirements for range characteristics (forage, water, space, etc.). Table 1 lists antelope requirements as developed to date for a sagebrush-grassland community. These requirements must be available in the correct combination. It is not sufficient to have an over abundance of one component and an inadequate quantity of another; nor can there be a total lack of any one.

Some ranges produce and maintain more antelope per range area than adjacent ranges because of the combination of habitat characteristics.

Recent studies (Sundstrom et al 1973, and Yoakum 1972) link antelope densities with vegetational communities. Table 2 provides a summary of these findings. It is apparent that high antelope numbers are related to the short grasslands and shrub-grassland steppes.

RECOMMENDED RANGE MANAGEMENT PRACTICES

VEGETATION

The primary principles of managing vegetation for antelope are:

1. Maintain existing native forage plants when the vegetation is in a good ecological condition and meets the requirements of antelope.
2. When the vegetation is in a poor ecological condition, or when one or more of the vegetative characteristics are inadequate for the antelope's habitat requirements, vegetative type conversions can be accomplished to correct the lacking quality components.

Native Rangeland

Native rangelands which have developed over eons into natural vegetative communities, and remain in good condition today, should be maintained in good condition. This is especially important to historical antelope ranges which possess vegetal characteristics favoring antelope habitat requirements identified in Table 1.

It is postulated that pronghorns thrive best on ranges in a subclimax vegetative condition. Such conditions were created by (1) wildfires caused by lightning, and (2) seasonal grazing by herbivores such as bison, elk (*Cervus* sp.), and deer (*Odocoileus* sp.). The vegetative community was in constant change which in turn produced a variety of mixed forage classes of grasses, forbs, and shrubs.

Vegetation Type Conversion

Extensive areas of dominant (more than 30 percent) big sagebrush (*Artemesia tridentata*) are often low density ranges for antelope. This is especially true where the brush is 76 cm. or higher. Such areas can be treated to decrease sagebrush quality and height thereby creating desirable antelope habitat. One of the major objectives of brush control is to decrease shrubs which are competing with grasses and forbs. Two points should be considered in such treatments: (1) it is best to plan projects not too large in size (preferably less than 405 ha); (2) the project should maintain around 5 to 10 percent shrub cover.

Brush control is frequently accomplished by mechanical practices such as plowing or chaining. Plowing with large brushland plows often kills native plants, especially highly preferred forbs. Chaining is accomplished by two large tractors pulling a heavy anchor chain between them. This practice does not kill as many shrubs and is less damaging to native grasses and forbs.

Chemical spraying is another commonly practiced shrub control technique. The spray can be largely plant specific thereby controlling sagebrush and not harming native grasses and most forbs. The practice can favor antelope ranges with low sagebrush but leaves tall dead shrubs on big sagebrush treated areas.

Prescribed burning has been used to date in only limited cases to improve antelope ranges. This practice has many natural characteristics favorable to improving ranges for antelope. When properly accomplished, prescribed burning can decrease dominant shrubs and create a more natural mixed community of grasses, forbs and shrubs (Beardahl and Sylvester 1974, Page 1975, and Lovaas 1976).

Antelope ranges having insufficient native plants for natural reproduction, can be seeded. Past seeding ventures have often resulted in monocultures of exotic grasses. These seedings have limited value to pronghorns other than a decrease in shrub quality and height. However, mixture seedings have often proven highly beneficial to pronghorns, especially when legumes have been planted. Mixture seedings are optimized when there are a number of native

species planted. A good rule of thumb is a minimum of 6 species each of grasses, forbs, and shrubs.

Introduction of dryland Nomad variety alfalfa (Medicago sativa) was one of the most successful techniques accomplished on antelope ranges in southeastern Oregon (Kindschy 1974). In excess of 22,700 ha involving 36 separate seedings have been planted to date. The alfalfa was generally aurally seeded onto plowed sagebrush ranges following drilling to adapted grasses and shrubs. Recent analysis of the seedings disclosed that the majority have maintained alfalfa composition at a level of 10 percent of the vegetation present over a six year or longer period. The seedings have increased the forb composition from 2 percent in untreated areas to 7 percent in seeded areas. During the August 1976 antelope census, more antelope does with fawns were observed in grass and forb seedings than on adjacent shrub dominant rangelands.

All vegetative type conversion projects should be planned in conformance with the basic principles and procedures for successful game range restoration identified by Plummer et al (1968). These procedures have wide application on similar sites throughout the West. They are referred to as "the 10 commandments for success" of game ranges, and briefly are:

- "1. Changes in plant cover by the proposed measures must be determined to be desirable.
2. Terrain and soil types must be suited to the changes selected.
3. Precipitation must be adequate to assure establishment and survival of seeded plants.
4. Competition must be low enough to assure that desired species can be established.
5. Only species and strains of plants adapted to the area should be planted.
6. Mixtures, rather than single species should be planted.
7. Sufficient seed of acceptable purity and viability should be planted to assure getting a stand.
8. Seed must be covered sufficiently.
9. Planting should be done in the season of optimum conditions for establishment.
10. The planted area must be adequately protected."

While there is still a great deal to be learned in developing precision to reduce costs, successful shrub treatment and seeding of large areas depends on following these time tested procedures. Their importance for planning and implementing vegetative manipulation for wildlife cannot be over emphasized.

Cultivated Crops

Antelope can be attracted to cultivated crops, especially alfalfa, a highly preferred forage species. Winter wheat is another crop to which pronghorns may cause depredation, mainly through mechanical means of trampling and bedding. Overall, pronghorn problems regarding the use of cultivated crops is minimal.

WATER

Quantity

Measurements were made of water consumption by antelope on the shrub-grass steppes of Wyoming (Sundstrom 1968). Daily water consumption rates per antelope varied from .34 liter per day in May to 4.5 liter per day in August. Total monthly precipitation, evaporation, succulent vegetation, nursing does, mean temperature, and average maximum temperature had marked effects on the average daily water consumption rates. Working in Utah, Beale (1966) found that from 1 July to 15 August, antelope on semi-arid lands consumed 1.1 to 1.9 liter of water daily.

Quality

Little information is available concerning water quality as it affects pronghorns. However, total dissolved solids and pH are probably the most common concerns. In the Red Desert region of Wyoming, Sundstrom (1968) found little or no use by antelope of water sources which contained total dissolved solids in excess of 5,000 ppm. The maximum total dissolved solids recommended for best game support is about 4,500 ppm (McKee and Wolf 1963).

In Wyoming's Red Desert, it was found that when water sources exceeded a pH of 9.25, antelope appeared to seek other water sources (Sundstrom 1968). Recommended pH level for most uses such as domestic water supplies, irrigation, fish and other aquatic life, swimming and other recreation uses, appears to be from 6.5 to 8.5 (McKee and Wolf 1963).

Distribution

A close relationship was observed between antelope and water distribution in Wyoming (Sundstrom 1968). Ninety-five percent of 12,000 antelope counted by air were within a 6 km radius of water.

Types of Developments

During a 5 year study of pronghorns in Wyoming, antelope were seen using every type of water source available. These consisted of

springs, creeks, rivers, lakes, and reservoirs (Figure 2), stock water developments, galvanized troughs fed by windmills, and troughs filled by springs. Antelope did not appear to avoid any manmade water device developed for livestock.

The installation of precipitation catchment facilities (guzzlers) on ranges lacking proper water distribution have been successful for antelope (June 1968, Sundstrom 1968). Such water developments are relatively maintenance free, not expensive, and serve a variety of wildlife and domestic livestock.

FENCES

Fences can be major obstacles when antelope mobility is restricted to procure food, water, or escape from deep snows. This is most paramount for traditional antelope migrating herds moving from summer to winter ranges. Where fence restrictions occur, significant changes in distribution of herds, death to individual pronghorns, or losses of carrying capacity have resulted (Oakley 1973, Sundstrom 1970, Martinka 1967, and Hailey et al 1977).

Recommendations from antelope-fence studies (Spillett 1965, Spillett et al 1967, Zobell 1968, Mapston 1972a, Interstate Antelope Conference 1962, and U.S. Bureau of Land Management 1975) state that when fence construction is necessary, the following specifications are best for antelope welfare:

1. Net-wire fences are generally barriers; therefore, their construction on antelope ranges is discouraged.
2. Barbed wire fences should be constructed to the following specifications:
 - a. bottom wire at least 41 cm from the ground.
 - b. next wire up 25 cm.
 - c. next wire up 25 cm, comprising a total of 91 cm height from ground.
 - d. bottom wire should be smooth wire, for antelope generally go under fences, barbless wire minimizes physical injuries.
 - e. no stays between posts, as this provides for a less tight fence allowing easier antelope passage.
 - f. important antelope travelled pathways, migration routes, etc., should allow for low-height or lay down panels, or pass structures.
 - g. keep fenced areas as large as possible, thereby providing an opportunity for antelope to obtain all the basic habitat requirements listed in Table 1.

"Antelope Passes" have been used in some areas to facilitate antelope movement through fences (June 1965, Mapston 1972b). These devices are essentially miniature cattle guards 122 cm wide rather than the standard 312 cm structures (Figure 1). Vehicles cannot cross these structures. "Antelope Passes" are placed at locations characteristically used by antelope. Corners of fence lines are a favorite location for the installation of this type of device. Passes, when properly placed, help facilitate antelope movement but are a second choice to properly constructed fencing.

GRAZING SYSTEMS

Livestock management is turning more to establishing grazing systems for livestock use of rangelands. There are numerous systems with designed procedures for grazing depending on local economic and environmental conditions. All of these systems should consider the following criteria when such systems are developed for lands used dually with wild pronghorn herds:

1. When allotting quality and quantity of vegetation for antelope, these forage needs will be given.
 - a. The right species of all vegetation will be recognized as forage for antelope. This includes grasses, forbs, and browse based upon correct up-to-date proper-use factors.
 - b. All forage plants will be assured availability for antelope for the seasons of need.
 - c. Forage will be reserved for a reasonable number of pronghorns. Reasonable numbers will be based upon (1) the average herd population for the past 30 years, and (2) average forage productions for the last 15 years.
2. All waters will be maintained for antelope for the seasons the antelope are in the pastures.
3. Livestock fence construction will meet specifications deemed appropriate for antelope movement specified in the Antelope Regional Fence Workshop (U.S. Bur. Land Mgmt. 1975).
4. When grazing systems are designed with key plant species, plans will include forb and browse as key species, thereby assuring that the systems will be based upon phenology of these key species for antelope habitat requirements.
5. Livestock grazing systems which restrict, alter, limit, or deleteriously affect the habitat requirements of antelope, must include mitigating measures and alternate procedures to enhance antelope habitat.
6. "Prescription grazing" - using livestock to achieve vegetative form or composition objectives - should be practiced in seedings and certain native ranges where high antelope habitat values exist.

DISCUSSION

Habitat improvements specifically designed to improve range conditions for pronghorns are few and have had possibly only a minor affect on antelope populations. However, many range improvements constructed for other purposes have had some major affects, both advantageously and deleteriously, on antelope. This entire subject is not well documented in reports or publications, but more information is becoming available and warrants discussion at this time.

Fences constructed to control livestock or delineate highway rights-of-way have been reported repeatedly as a serious mortality factor to antelope. Such reports are substantiated for the open grasslands of Wyoming (Oakley 1973) to the semi-arid regions of Texas (Hailey 1977). The deleterious affect of both direct entanglement mortality and the much greater factor of entrapment and restricting migrational movements for survival are well documented. This does not mean that all fences are problems to antelope everywhere, but the evidence is substantial that fences are a serious mortality problem to certain antelope herds on a regional basis. It is also known that proper fence construction planning to include designs allowing more free antelope movement would do much to enhance antelope welfare (U.S. Bureau of Land Management 1974). It would be well for all managers responsible for planning and constructing fences on ranges where wildlife values are of importance, to consider the tried and tested fence designs which allow access by antelope.

Just how beneficial vegetative type conversions or water developments have been to pronghorns, is a matter not quantitatively reported to date. However, this subject is becoming increasingly apparent as more cases become known. There are two recent cases that substantiate well the values of multiple range improvements for the benefit of antelope.

At the third biennial Antelope States Workshop, Kerr (1968) reported on the interrelationships of antelope to habitat for the Tres Piedras herd in north central New Mexico. This area underwent extensive vegetative type conversions, fence construction, and water developments primarily for livestock but with proper considerations for antelope habitat requirements. The results within three years recorded a 130 percent (from 300 to 750) increase in the antelope population.

The second case of a large-scale range rehabilitation program affecting antelope numbers is the Vale project in southeastern Oregon. The project encompasses 100 - by 180 km of primarily sagebrush-grassland steppe rangelands. During an 11-year period, approximately \$10 million was spent on the following range improvements: 205,000 ha brush control; 108,000 ha seedings; 3,330 km fence construction; 1,600

water developments and 741 km of pipelines (Heady and Bartolome 1977). The adjacent rangelands in Oregon, Idaho, and Nevada had only minor range improvements accomplished during this same 11-year period.

Now three years following the Vale project, it has been substantiated that the antelope population has increased 100 percent (from 1,000 to 2,000) while at the same time, antelope in surrounding adjacent rangelands have remained relatively static. The evidence is circumstantial, but it is indicative that properly implemented large-scale vegetative manipulation projects combined with water developments can be highly beneficial to wild free-roaming antelope herds.

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Vegetation community Number %

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Grassland community	291,950	85
Shrubland community	51,130	15
Forest community	1,000	1
Other community	10,000	3
Total	354,080	100
Devil		
Other	1,170	1

TABLE 1. ANTILOPINE ANTELOPE POPULATION IN THE COLORADO ROCKIES AND ADJACENT MOUNTAINS IN 1972. (Continued)

Vegetation community	Number	%
Grassland community	291,950	85
Shrubland community	51,130	15
Forest community	1,000	1
Other community	10,000	3
Total	354,080	100
Devil		
Other	1,170	1

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TABLE 1. ESTIMATED ANTELOPE POPULATIONS
INHABITATING GRASSLAND AND GRASSLAND-
BRUSHLAND COMMUNITIES (YOAKUM, 1972)
IN CANDAA, MEXICO AND THE CONTINEN-
TAL UNITED STATES

Vegetational community	Number	% of popu- lation
Grasslands		
Shortgrass	190,210	49
Mixedgrass	71,750	19
Total	261,960	68
Grassland-Shrubland		
Bunchgrass-Sagebrush	103,810	27
Grama-Mesquite	4,600	1
Galleta-Woodland	10,950	3
Total	119,360	31
Desert		
Hot and cold	4,170	1

TABLE 2. CHECKLIST OF PRONGHORN ANTELOPE REQUIREMENTS FOR HABITAT IN A
GRASSLAND-SAGEBRUSH COMMUNITY.

Habitat characteristics	Antelope requirement ^a	Habitat characteristics	Antelope requirement ^a
ABIOTIC		BIOTIC (Cont'd)	
1. Physiography	Large expanse area (10 miles minimum) - low rolling terrain - no major physical barriers (large rivers, mountain ranges, etc.)	2. Animal	Succulence: - The more available year round the better in all plant species Communities: - Variety and diversity important (meadows, intermittent lake beds, wild fire burns, etc.) Height: - No higher than 24" preferably from 12-24"
2. Climate - precipitation - snow depth - temperature	10-15" Not over 10-15" for prolonged periods Not a factor—populations in hot deserts to alpine meadows		big game: Tolerable of all species Predators: Affect antelope to some extent, but rarely a limiting factor Man: Can or cannot be problem based on two major factors: - Effective enforcement of indiscriminate year long killing - Methods and practices of habitat or range management (Maintaining or improving vegetation, waters, fences, etc.)
3. Soils	Not a determining factor except to soilsite relationships in which some sites do not grow the right vegetation		
4. Water	Desirable to have one quarter to one gallon per day for every day of year, particularly warm seasons. Water distribution every 3 to 4 miles		
BIOTIC			
1. Vegetation	Ground cover—most ranges have around 50% non-vegetation Composition: - 40-60% Grass - 10-30% Forbs - 5-10% Browse Variety: - Grass - 5 to 10 species - Forbs - 20 to 40 species - Browse - 5 to 10 species		

^aThese requirements must be available in the right combinations. Too much or too little of any one may become the major factor limiting antelope production or survival.



Fig. 1. An adult doe antelope jumps through an "antelope pass" structure constructed in a range fence near Casper, Wyoming.
(Photo by Ray Mapston)



Fig. 2. Large open "dugout" water catchment pits, as portrayed above, have been highly used by antelope as well as livestock near Lakeview, Oregon. (Photo by Jim Yoakum)

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